CHP-Ready assessment template

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CHP-Ready assessment template

This is a Word version of Appendix A of our CHP Ready guidance for combustion and energy from waste power plants for you to use as a template

You can use this template to carry out a CHP-Ready assessment if you are making an environmental permit application for a new combustion or energy from waste power plant. This is a copy of the CHP-R Assessment Form in Appendix A of the CHP Ready Guidance and we recommend you read the guidance before completing it.

We would normally expect you to discuss CHP-Readiness as part of the pre-application process for your permit, and so if you have any queries about completing this template, please speak to the local Natural Resources Wales Officer allocated to your pre-application.

#	Description	Units	Notes / Instructions
Requirement 1: Plant, Plant location and Potential heat loads			
1.1	**Plant name**		The plant name
1.2	**Plant description**		To include a basic description of the plant, considering (as a minimum): • the type of plant • the rated gross thermal input (based on the Higher Heating Value (HHV)) of the plant • the maximum continuous electrical power rating • the proposed fuel(s) • the proposed combustion technology; and • High-level discussion of the anticipated plant design (e.g. number of combustion units / number of steam turbines / cooling technology)
1.3	**Plant location (Postcode / Grid Ref)**		The location of the plant. This should include a plan showing the proposed plant site boundary, and the land in its vicinity.

1.4	**Factors influencing selection of plant location**		This should include a description of the factors that have been used to select the location of the plant. The description should make reference to the following factors as appropriate: • likely potential for CHP opportunities* • availability of sufficient land capacity • current land use* • compatibility with the policies of the relevant Local Plan(s) and the NPPF together with other relevant planning considerations • CHP provisions contained within the relevant Planning documents* • environmental considerations (such as proximity to sensitive receptors including: Air Quality Management Areas (AQMAs); and Statutory Designated Sites [and the likely presence of Protected Species]) • proximity of suitable connection point to the National Grid Electricity Transmission System, and available capacity for export to the Electricity Transmission System • proximity to / availability of fuel source • proximity to / availability of cooling water • likely suitability for CCS (if applicable)*; and Any other relevant considerations. *For the purposes of demonstrating CHP-R the items marked (*) must be included.

1.5	**Operation of plant**		
a)	Proposed operational plant load	%	This should clearly describe the proposed operating load point of the plant. For example: • for gas turbine plant, this should comprise the number of gas turbines in operation and the load as % of gas turbine base load. • for steam plant, this should comprise the main steam flow as a percentage of maximum turbine continuous rating (%TMCR).
b)	Thermal input at proposed operational plant load	MW	The plant thermal input (based on the Lower Heating Value (LHV)) at proposed operational plant load. Identified from modelling.
c)	Net electrical output at proposed operational plant load	MW	The plant net electrical output at proposed operational plant load. Identified from modelling.
d)	Net electrical efficiency at proposed operational plant load	%	The plant net electrical efficiency at proposed operational plant load based on the LHV. Identified from modelling.
e)	Maximum plant load	%	This is the maximum possible plant load. The value to be used is 100%.
f)	Thermal input at maximum plant load	MW	The plant thermal input (based on the LHV) at 100% plant load. Identified from modelling.
g)	Net electrical output at maximum plant load	MW	The plant net electrical output at 100% plant load. Identified from modelling. This is represented by Point D on Insert 3.
h)	Net electrical efficiency at maximum plant load	%	The plant net electrical efficiency at 100% plant load based on the LHV. Identified from modelling. This is represented by Point D on Insert 3.

i)	minimum stable plant load	%	This is the minimum stable plant load. This will vary with type of plant, and may be governed by the combustion stability or capability to meet emissions limits at low plant loads.
j)	Thermal input at minimum stable plant load	MW	The plant thermal input (based on the LHV) at minimum stable plant load.
k)	Net electrical output at minimum stable plant load	MW	The plant net electrical output at minimum stable plant load. Identified from modelling. This is represented by Point A on Insert 3.
l)	Net electrical efficiency at minimum stable plant load	%	The plant net electrical efficiency at minimum stable plant load based on the LHV. Identified from modelling. This is represented by Point A on Insert 3.
1.6	**Identified potential heat loads**		
			This should include a description of the identified potential heat loads in the vicinity of the plant. A plan showing all identified potential heat loads in the vicinity should be provided. For each potential heat load the following information should be provided: • name of identified heat load / recipient • size of heat load (MW) • location of identified heat load / recipient including distance from the plant(where the identified heat load / recipient is a District Heating Network, the primary service location(s) should be provided) • nature of use of potential heat load • typical export and return requirements of the potential heat load.

1.7	**Selected heat load(s)**		
a)	Category (e.g. industrial / district heating)		Of the identified potential heat loads under Requirement 1.6, appropriate selection of heat loads should be undertaken in discussion with the Potential Heat Load Recipient / Environment Agency. It should be noted that the heat loads for assessment must be agreed with the Environment Agency If more than one heat load is taken forward, then an assessment should be undertaken for all selected heat loads.
b)	Maximum heat load extraction required	MW	Of the identified potential heat loads under Requirement 1.6, appropriate selection of heat loads should be undertaken in discussion with the Potential Heat Load Recipient / Environment Agency. It should be noted that the heat loads for assessment must be agreed with the Environment Agency **If more than one heat load is taken forward, then an assessment should be undertaken for all selected heat loads.**
1.8	**Export and return requirements of heat load**		
a)	Description of heat load extraction		To complete, based on potential heat load extraction for CHP (e.g. steam / hot water)
b)	Description of heat load profile		To complete, based on potential heat load profile (e.g. constant or intermittent / fixed or variable load)
c)	Export pressure	bar a	To complete, based on the requirements at the terminal point with the heat load customer.
d)	Export temperature	°C	To complete, based on the requirements at the terminal point with the heat load customer.
e)	Export flow	t/h	To complete, based on the requirements at the terminal point with the heat load customer.
f)	Return pressure	bar a	To complete, if applicable, based on the requirements at the terminal point with the heat load customer.

g)	Return temperature	°C	To complete, if applicable, based on the requirements at the terminal point with the heat load customer.
h)	Return flow	t/h	To complete, if applicable, based on the requirements at the terminal point with the heat load customer.
Requirement 2: Identification of CHP Envelope			
2.0	**Comparative efficiency of a standalone boiler for supplying the heat load**	90 % LHV	This is used only to calculate the primary energy savings (or reduction in primary energy usage) as a comparative guide.
2.1	**Heat extraction at 100% plant load**		
a)	Maximum heat load extraction at 100% plant load	MW	This is the maximum possible heat load extraction within the technical limitations of the plant at 100% plant load (i.e. heat load extraction beyond which major plant modification would be required). This will vary with type of plant. This is represented by Point C on Insert 3.
b)	Maximum heat extraction export flow at 100% plant load	t/h	This should be consistent with the: • steam conditions given in 1.8; and • the figure given in 2.1(a).
c)	CHP mode net electrical output at 100% plant load	MW	The plant with CHP net electrical output at 100% plant load. Identified from modelling. This is represented by Point C on Insert 3.
d)	CHP mode net electrical efficiency at 100% plant load	%	The plant with CHP net electrical efficiency at 100% plant load based on the LHV. Identified from modelling. This is represented by Point C on Insert 3.
e)	CHP mode net CHP efficiency at 100% plant load	%	The plant with CHP net CHP efficiency at 100% plant load based on the LHV. Identified from modelling. This is represented by Point C on Insert 3.

f)	Reduction in primary energy usage for CHP mode at 100% plant load	%	The reduction in primary energy usage (i.e. measure of primary energy savings) is based on the EED and is given by: $$\left[1 - \frac{1}{\frac{CHP\ H_\eta}{Ref\ H_\eta} + \frac{CHP\ E_\eta}{Ref\ E_\eta}}\right] \cdot 100$$ Or (with reference to the values calculated in this CHP-R Assessment) this can also be given by: $$\left[1 - \frac{1}{\frac{CHP_\eta}{H+E}\left[\frac{H}{Ref\ H_n} + \frac{E}{Ref\ E_n}\right]}\right] \cdot 100$$ Where: CHP Hη : CHP Heat Efficiency CHP Eη : CHP Electrical Efficiency CHPη : CHP Efficiency Ref Hη : Reference Heat Efficiency1 Ref Eη : Reference Electrical Efficiency2 H : Heat Load Extraction E : CHP Mode Net Electrical Output
2.2	**Heat extraction at minimum stable plant load**		
a)	Maximum heat load extraction at minimum stable plant load	MW	This is the maximum possible heat load extraction within the technical limitations of the plant at minimum stable plant load (i.e. heat load extraction beyond which major plant modification would be required). This will vary with type of plant. This is represented by Point B on Insert 3.
b)	Maximum heat extraction export flow at minimum stable plant load	t/h	This should be consistent with the: Steam conditions given in 1.8; and The figure given in 2.2(a).

[1] This is the Comparative Efficiency of a Standalone Boiler for supplying the Heat Load [2.0].

[2] This is the power plant net electrical efficiency without heat extraction.

c)	CHP mode net electrical output at minimum stable plant load	MW	The plant with CHP net electrical output at minimum stable plant load. Identified from modelling. This is represented by Point B on Insert 3.
d)	CHP mode net electrical efficiency at minimum stable plant load	%	The plant with CHP net electrical efficiency at minimum stable plant load based on the LHV. Identified from modelling. This is represented by Point B on Insert 3.
e)	CHP mode net CHP efficiency at minimum stable plant load	%	The plant with CHP net CHP efficiency at minimum stable plant load based on the LHV. Identified from modelling. This is represented by Point B on Insert 3.
f)	Reduction in primary energy usage for CHP mode at minimum stable plant load	%	The reduction in primary energy usage (i.e. measure of primary energy savings) is based on the EED. This is given by 2.1(f).
2.3	**Can the plant supply the selected identified potential heat load (i.e.is the identified potential heat load within the 'CHP envelope')?**		Should be identified: Yes or No
Requirement 3: Operation of the Plant with the Selected Identified Heat Load			
3.1	**Proposed operation of plant with CHP**		
a)	CHP mode net electrical output at proposed operational plant load	MW	The plant with CHP net electrical output at proposed operational plant load. Identified from modelling. This is represented by Point E on Insert 3.
b)	CHP mode net electrical efficiency at proposed operational plant load	%	The plant with CHP net electrical efficiency at proposed operational plant load based on the LHV. Identified from modelling. This is represented by Point E on Insert 3.

c)	CHP mode net CHP efficiency at proposed operational plant load	%	The plant with CHP net CHP efficiency at proposed operational plant load based on the LHV. Identified from modelling. This is represented by Point E on Insert 3.
d)	Reduction in net electrical output for CHP mode at proposed operational plant load	MW	The extraction of heat from the plant will cause a corresponding loss in electrical power. Typically, the higher the quality of the extracted heat, the greater the corresponding loss in electrical power. The reduction in electrical power output due to the heat load extraction at proposed operational plant load is given by: (Net Electrical Output at Proposed Operational Plant Load) – (CHP Mode Net Electrical Output at Proposed Operational Plant Load).
e)	Reduction in net electrical efficiency for CHP mode at proposed operational plant load	%	The reduction in net electrical efficiency (based on the LHV due to the heat load extraction at proposed operational plant load is given by: (Net Electrical Efficiency at Proposed Operational Plant Load) – (CHP Mode Net Electrical Efficiency at Proposed Operational Plant Load).
f)	Reduction in primary energy usage for CHP mode at proposed operational plant load	%	The reduction in primary energy usage (i.e. measure of primary energy savings) is based on the EED. This is given by 2.1(f).
g)	Z ratio		The Z-Ratio compares the heat exported to the reduction in electrical power. A higher Z-Ratio indicates a more efficient method of heat supply. This is given by: (Maximum Heat Load Extraction Required) / (Reduction in Net Electrical Output for CHP Mode at Proposed Operational Plant Load)
Requirement 4: Technical provisions and space requirements			

4.1	**Description of likely suitable extraction points**		Demonstration of CHP-R does not require that suitable extraction points are fitted from the outset, but rather it is technically feasible to retrofit at a later date. Therefore, based on the likely heat load, a suitable method (or suitable methods) of extraction should be identified, along with the associated technical requirements of such extraction. For example, for heat load extraction from a CCGT power plant for a District Heating Scheme, a quantity of low pressure steam would be required. A suitable method of extraction would involve extracting a quantity of low pressure steam from the Intermediate Pressure / Low Pressure Turbine Crossover (if present). If this is not possible, but steam can be extracted from the Cold Reheat Pipe, a suitable method of extraction would involve extracting the steam and passing it through a let-down station or back pressure steam turbine. Additional information is presented in Appendix D.
4.2	**Description of potential options which could be incorporated in the plant, should a CHP opportunity be realised outside the 'CHP envelope'**		If heat load extraction in sufficient quantities is not possible, consideration should be given to potential options which could be incorporated into the plant should the realised CHP opportunity be outside the identified 'CHP Envelope'. For example: • back-up boilers operated by the plant operator / head load recipient, and • the use of heat storage equipment
4.3	**Description of how the future costs and burdens associated with supplying the identified heat load / potential CHP opportunity have been minimised through the implementation of an appropriate CHP-R design**		A description of how the future costs and burdens of CHP have been minimised. This may include discussions with major plant or component manufactures to investigate modifications to design which could allow for the maximum heat supply without compromising the initial performance, flexibility and reliability of the plant.

4.4	**Provision of site layout of the plant, indicating available space which could be made available for CHP-R**		Following identification of suitable extraction points and potential options which could be incorporated into the design of the plant should a CHP opportunity be realised outside the 'CHP Envelope', demonstration of CHP-R comprises indication of the available space for the extraction points / potential options. For example: When operating within the 'CHP Envelope', in addition to the extraction points, there may be a need for space to be provided for: • supply and return pipes within the plant site, for steam and / or hot water • the Water Treatment Plant / Demineralisation Plant, which may need to be increased in size if steam is to be piped off-site without condensate return • a let-down station or back pressure steam turbine, and, • back-up boilers, which could supply heat in the event that the plant is off-line When operating outside the 'CHP Envelope', there may be a need for space to be provided for: • back-up boilers, and • heat storage equipment It is noted that the available space for the provision of additional balance of plant systems / control and instrumentation systems should be in the most suitable location, and therefore may not always be on the plant site itself.

Requirement 5: Integration of CHP and carbon capture			
5.1	**Is the plant required to be CCR?**		Should be identified: Yes or No
5.2	**Export and return requirements identified for carbon capture**		
	100% plant load		
a)	Heat load extraction for carbon capture at 100% plant load	MW	This is the heat load extraction required for carbon capture at 100% Plant Load. This does not include the heat available for export.
b)	Description of heat export (e.g. steam / hot water)		To complete, based on the likely heat load extraction for carbon capture at 100% Plant Load.
c)	Export pressure	bar a	To complete, based on the likely requirements at the terminal point with the Carbon Capture Plant at 100% Plant Load.
d)	Export temperature	°C	To complete, based on the likely requirements at the terminal point with the Carbon Capture Plant at 100% Plant Load.
e)	Export flow	t/h	To complete, based on the likely requirements at the terminal point with the Carbon Capture Plant at 100% Plant Load.
f)	Return pressure	bar a	To complete, based on the likely requirements at the terminal point with the Carbon Capture Plant at 100% Plant Load.
g)	Return temperature	°C	To complete, based on the likely requirements at the terminal point with the Carbon Capture Plant at 100% Plant Load.
h)	Return flow	t/h	To complete, based on the likely requirements at the terminal point with the Carbon Capture Plant at 100% Plant Load.
i)	Likely suitable extraction points		Based on the likely heat load extraction for carbon capture a suitable method (or suitable methods) of extraction should be identified.
	Minimum stable plant load		

j)	Heat load extraction for carbon capture at minimum stable plant load	MW	This is the heat load extraction required for carbon capture at Minimum Stable Plant Load. This does not include the heat available for export.

k)	Description of heat export (e.g. steam / hot water)		To complete, based on the likely heat load extraction for carbon capture at Minimum Stable Plant Load.
l)	Export pressure	bar a	To complete, based on the likely requirements at the terminal point with the Carbon Capture Plant at Minimum Stable Plant Load.
m)	Export temperature	°C	To complete, based on the likely requirements at the terminal point with the Carbon Capture Plant at Minimum Stable Plant Load.
n)	Export flow	t/h	To complete, based on the likely requirements at the terminal point with the Carbon Capture Plant at Minimum Stable Plant Load.
o)	Return pressure	bar a	To complete, based on the likely requirements at the terminal point with the Carbon Capture Plant at Minimum Stable Plant Load.
p)	Return temperature	°C	To complete, based on the likely requirements at the terminal point with the Carbon Capture Plant at Minimum Stable Plant Load.
q)	Return flow	t/h	To complete, based on the likely requirements at the terminal point with the Carbon Capture Plant at Minimum Stable Plant Load.
r)	Likely suitable extraction points		Based on the likely heat load extraction for carbon capture, a suitable method (or suitable methods) of extraction should be identified.
5.3	**Operation of plant with carbon capture (without CHP)**		
a)	Maximum plant load with carbon capture	%	This is the maximum possible plant load with carbon capture. The value to be used is 100%.
b)	Carbon capture mode thermal input at maximum plant load	MW	The plant with carbon capture thermal input (based on the LHV) at 100% plant load. Identified from modelling.
c)	Carbon capture mode net electrical output at maximum plant load	MW	The plant with carbon capture net electrical output at 100% plant load. Identified from modelling.
d)	Carbon capture mode net electrical efficiency at maximum plant load	%	The plant with carbon capture net electrical efficiency at 100% plant load based on the LHV. Identified from modelling.

e)	Minimum stable plant load with CCS	%	This is the minimum stable plant load with carbon capture. This will vary with type of plant.
f)	Carbon capture mode CCS thermal input at minimum stable plant load	MW	The plant with carbon capture thermal input (based on the LHV) at minimum stable plant load.
g)	Carbon capture mode net electrical output at minimum stable plant load	MW	The plant with carbon capture net electrical output at minimum stable plant load. Identified from modelling.
h)	Carbon capture mode net electrical efficiency at minimum stable plant load	%	The plant with carbon capture net electrical efficiency at minimum stable plant load based on the LHV. Identified from modelling.
5.4	**Heat extraction for CHP at 100% plant load with carbon capture**		
a)	Maximum heat load extraction at 100% plant load with carbon capture [H]	MW	This is the maximum possible heat load extraction within the technical limitations of the plant with carbon capture at 100% plant load (i.e. heat load extraction beyond which major plant modification would be required). This will vary with type of plant, and Carbon Capture Plant requirement.
b)	Maximum heat extraction export flow at 100% plant load with carbon capture	t/h	This should be consistent with the: Steam conditions given in 1.8; and The figure given in 5.4(a).
c)	Carbon capture and CHP mode net electrical output at 100% plant load	MW	The plant with carbon capture and CHP net electrical output at 100% plant load. Identified from modelling.
d)	Carbon capture and CHP mode net electrical efficiency at 100% plant load	%	The plant with carbon capture and CHP net electrical efficiency at 100% plant load based on the LHV. Identified from modelling.
e)	Carbon capture and CHP mode net CHP efficiency at 100% plant load	%	The plant with carbon capture and CHP net CHP efficiency at 100% plant load based on the LHV. Identified from modelling.
f)	Reduction in primary energy usage for carbon capture and CHP mode at 100% plant load	%	The reduction in primary energy usage (i.e. measure of primary energy savings) is based on the EED. This is given by 2.1(f).

5.5	**Heat extraction at minimum stable plant load with carbon capture**		
a)	Maximum heat load extraction at minimum stable plant load with carbon capture	MW	This is the maximum possible heat load extraction within the technical limitations of the plant with carbon capture at minimum stable plant load (i.e. heat load extraction beyond which major plant modification would be required). This will vary with type of plant, and Carbon Capture Plant requirement.
b)	Maximum heat extraction export flow at minimum stable plant load with carbon capture	t/h	This should be consistent with the: Steam conditions given in 1.8; and The limit given in 5.5(a).
c)	Carbon capture and CHP mode net electrical output at minimum stable plant load	MW	The plant with carbon capture and CHP net electrical output at minimum stable plant load. Identified from modelling.
d)	Carbon capture and CHP mode net electrical efficiency at minimum stable plant load	%	The plant with carbon capture and CHP net electrical efficiency at minimum stable plant load based on the LHV. Identified from modelling.
e)	Carbon capture and CHP mode net CHP efficiency at minimum stable plant load	%	The plant with carbon capture and CHP net CHP efficiency at minimum stable plant load based on the LHV. Identified from modelling.
f)	reduction in primary energy usage for carbon capture and CHP mode at minimum stable plant load	%	The reduction in primary energy usage (i.e. measure of primary energy savings) is based on the EED. This is given by 2.1(f).
5.6	**Can the plant with carbon capture supply the selected identified potential heat load (i.e. is the identified potential heat load within the 'CHP and carbon capture envelope')?**		Should be identified: Yes or No

5.7	**Description of potential options which could be incorporated in the plant for useful integration of any realised CHP system and carbon capture system**		The Carbon Capture Plant will reject large quantities of heat. A description of potential uses of this heat should be provided with regard to how it could be used in any CHP System. If this is not possible, consideration should be given to potential options which could be incorporated into the plant with carbon capture should the realised CHP opportunity be outside the identified 'CHP and Carbon Capture Envelope'.
Requirement 6: Economics of CHP-R			
6.1	**Economic assessment of CHP-R**		A clear summary of the high level economic assessment (or Cost-Benefit Analysis) should be provided, stating for the selected potential future opportunity for heat supply, the associated potential future revenues / benefits and likely additional initial costs for the plant to be CHP-R. Unless it can be demonstrated that the additional initial costs for the plant to be CHP-R would be excessive (and outweigh the associated potential future revenues / benefits), it is considered that the economic viability of CHP-R is demonstrated.
BAT assessment			
	Is the new plant a CHP plant at the outset (i.e.are there economically viable CHP opportunities at the outset)?		Should be identified: Yes or No. If yes, then the new plant is considered BAT.
	If not, is the new plant a CHP-R plant at the outset?		Should be identified: Yes or No If no, applicants should provide evidence as to why their plant should be excluded from being CHP-R.
	Once the new plant is CHP-R, is it BAT?		Should be identified: Yes or No (as a result of periodic reviews of opportunities for heat supply once the CHP-R plant becomes operational).